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(54) **POWER SUPPLY AVOIDING AUXILIARY BOOST CIRCUIT OVER VOLTAGE**

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H02M 7/04	(2006.01)
H02M 1/42	(2007.01)
H02M 1/36	(2007.01)

(52) **U.S. Cl.**
CPC ***H02M 1/32*** (2013.01); ***H02M 1/36*** (2013.01); ***H02M 1/42*** (2013.01); ***H02M 7/04*** (2013.01); *H02M 2001/007* (2013.01); *H02M 2001/0096* (2013.01)

(58) **Field of Classification Search**
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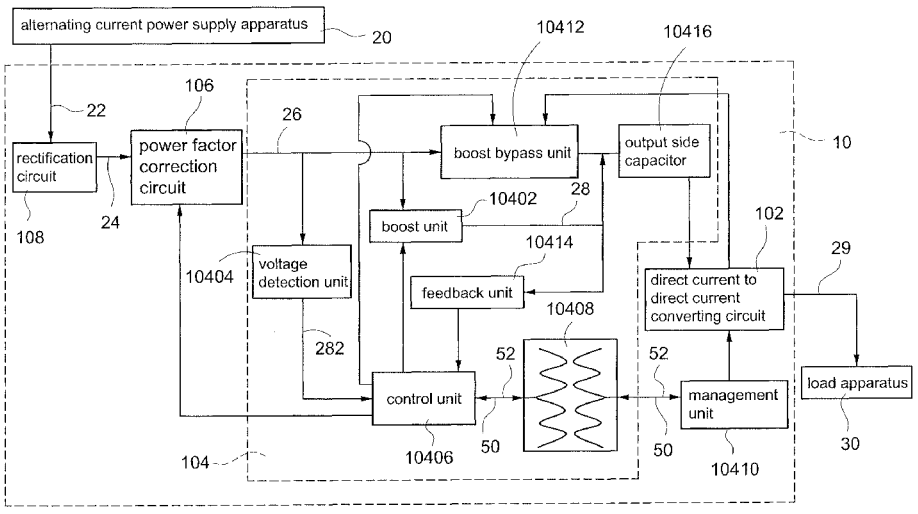
(57) **ABSTRACT**

A power supply avoiding an auxiliary boost circuit over voltage includes a direct current to direct current converting circuit, the auxiliary boost circuit and a power factor correction circuit. The auxiliary boost circuit includes a voltage detection unit, a control unit, a management unit and a boost unit. When the voltage detection unit detects that an output voltage of the power factor correction circuit is less than a predetermined voltage, the control unit enters a hold up time mode. Before the hold up time mode is finished, the control unit sends a first synchronization signal to the management unit, so that the management unit sends a second synchronization signal to the control unit, so that the control unit turns off the boost unit before or at the same time the management unit turns off the direct current to direct current converting circuit.

5 Claims, 2 Drawing Sheets



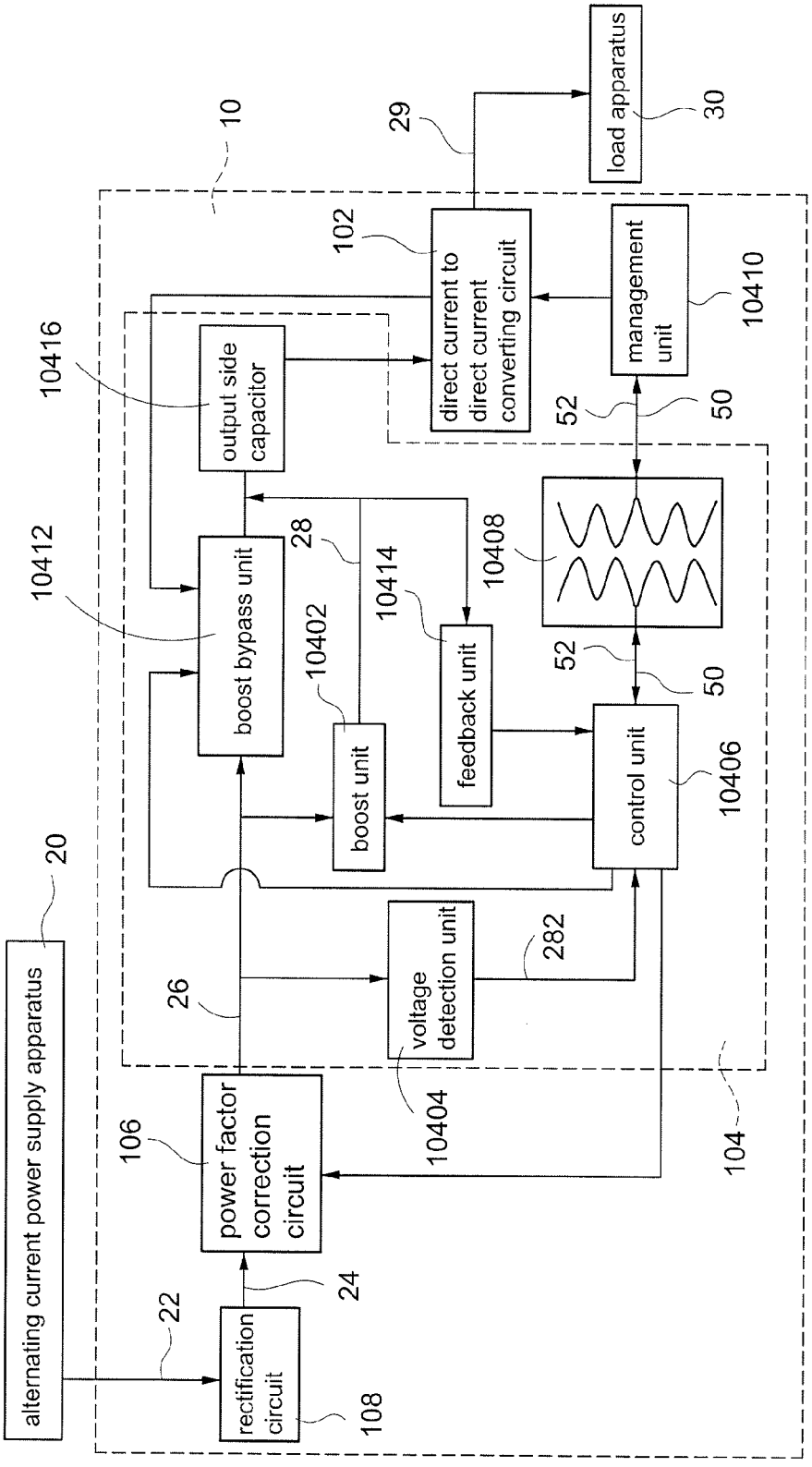

alternating current power supply apparatus
20
22
rectification circuit
108
24
power factor correction circuit
106
26
voltage detection unit
282
10404
boost bypass unit
10412
boost unit
10402
feedback unit
10414
28
output side capacitor
10416
direct current to direct current converting circuit
102
10
29
load apparatus
30
management unit
10410
52
50
10408
control unit
10406
104

FIG.1

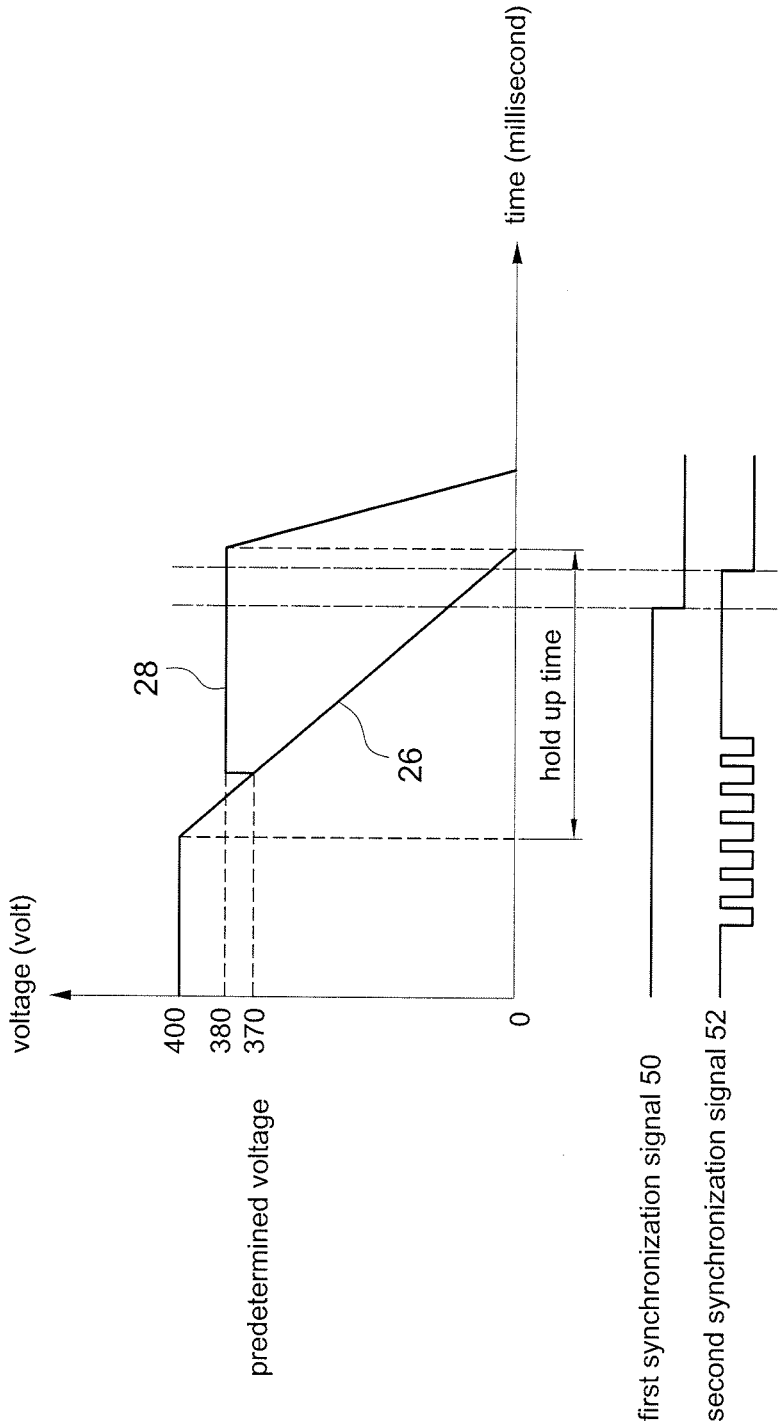

time (millisecond)
voltage (volt)
400
380
370
0
predetermined voltage
28
26
hold up time
first synchronization signal 50
second synchronization signal 52

FIG.2

POWER SUPPLY AVOIDING AUXILIARY BOOST CIRCUIT OVER VOLTAGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a power supply, and especially relates to a power supply avoiding an auxiliary boost circuit over voltage.

2. Description of the Related Art

When a related art alternating current power supply apparatus stops supplying an alternating current power to a related art power supply, an output voltage of the related art power supply will not drop to zero volt immediately. The output voltage will drop to zero volt gradually, so that a direct current to direct current converting circuit of the related art power supply and a load apparatus are protected. However, the direct current to direct current converting circuit may be still damaged by the variation of the output voltage. Therefore, the components in the direct current to direct current converting circuit must have high specifications (for example, high voltage resistance), so that the cost of the direct current to direct current converting circuit is increased.

SUMMARY OF THE INVENTION

In order to solve the above-mentioned problems, an object of the present invention is to provide a power supply avoiding an auxiliary boost circuit over voltage.

In order to achieve the object of the present invention mentioned above, the power supply comprises a direct current to direct current converting circuit, the auxiliary boost circuit, a power factor correction circuit and a rectification circuit. The direct current to direct current converting circuit outputs a direct current electric power. The auxiliary boost circuit is electrically connected to the direct current to direct current converting circuit. The power factor correction circuit is electrically connected to the auxiliary boost circuit. The rectification circuit is electrically connected to the power factor correction circuit. The auxiliary boost circuit comprises a boost unit, a voltage detection unit, a control unit, a management unit and an output side capacitor. The boost unit is electrically connected to the direct current to direct current converting circuit and the power factor correction circuit. The voltage detection unit is electrically connected to the power factor correction circuit and the boost unit. The control unit is electrically connected to the power factor correction circuit, the boost unit and the voltage detection unit. The management unit is electrically connected to the direct current to direct current converting circuit. The output side capacitor is electrically connected to the direct current to direct current converting circuit and the boost unit. When the voltage detection unit detects that an output voltage of the power factor correction circuit is less than a predetermined voltage, the control unit enters a hold up time mode to drive the boost unit to increase the output voltage to obtain a boost voltage. The output side capacitor receives the boost voltage to supply power to the direct current to direct current converting circuit. Before the hold up time mode is finished, the control unit sends a first synchronization signal to the management unit. After the management unit receives the first synchronization signal, the management unit sends a second synchronization signal to the control unit. After the control unit receives the second synchronization signal sent from the management unit, the control unit turns off the boost unit before or at the same time the management unit turns off the direct current to direct current converting circuit.

The advantage of the present invention is to turns off the auxiliary boost circuit and the direct current to direct current converting circuit at the same time. Or the auxiliary boost circuit is turned off first, and then the direct current to direct current converting circuit is turned off. Therefore, the over voltage phenomenon of the auxiliary boost circuit is eliminated, and the reliability of the power supply is improved.

BRIEF DESCRIPTION OF DRAWING

FIG. **1** shows a block diagram of a power supply avoiding an auxiliary boost circuit over voltage of the present invention.

FIG. **2** shows a waveform diagram of an embodiment of the output voltage and the boost voltage of the power supply of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Please refer to following detailed description and figures for the technical content of the present invention. The following detailed description and figures are referred for the present invention, but the present invention is not limited to it.

FIG. **1** shows a block diagram of a power supply avoiding an auxiliary boost circuit over voltage of the present invention. A power supply **10** avoiding an auxiliary boost circuit **104** over voltage is applied to an alternating current power supply apparatus **20** and a load apparatus **30**. The power supply **10** comprises a direct current to direct current converting circuit **102**, the auxiliary boost circuit **104**, a power factor correction circuit **106** and a rectification circuit **108**. The auxiliary boost circuit **104** comprises a boost unit **10402**, a voltage detection unit **10404**, a control unit **10406**, an isolation unit **10408**, a management unit **10410**, a boost bypass unit **10412**, a feedback unit **10414** and an output side capacitor **10416**.

The direct current to direct current converting circuit **102** is electrically connected to the load apparatus **30**. The auxiliary boost circuit **104** is electrically connected to the direct current to direct current converting circuit **102**. The power factor correction circuit **106** is electrically connected to the auxiliary boost circuit **104**. The rectification circuit **108** is electrically connected to the power factor correction circuit **106**. The boost unit **10402** is electrically connected to the direct current to direct current converting circuit **102** and the power factor correction circuit **106**. The voltage detection unit **10404** is electrically connected to the power factor correction circuit **106** and the boost unit **10402**. The control unit **10406** is electrically connected to the power factor correction circuit **106**, the boost unit **10402** and the voltage detection unit **10404**. The management unit **10410** is electrically connected to the direct current to direct current converting circuit **102**. The output side capacitor **10416** is electrically connected to the direct current to direct current converting circuit **102** and the boost unit **10402**. The boost bypass unit **10412** is electrically connected to the direct current to direct current converting circuit **102**, the power factor correction circuit **106**, the boost unit **10402**, the voltage detection unit **10404** and the control unit **10406**. The feedback unit **10414** is electrically connected to the direct

current to direct current converting circuit **102**, the boost unit **10402**, the control unit **10406** and the boost bypass unit **10412**.

The direct current to direct current converting circuit **102** outputs a direct current electric power **29**. The direct current to direct current converting circuit **102** comprises a primary side and a secondary side. The control unit **10406** is arranged in the primary side. The management unit **10410** is arranged in the secondary side. The control unit **10406** is electrically connected to the management unit **10410** through the isolation unit **10408**.

The alternating current power supply apparatus **20** sends an alternating current power **22** to the rectification circuit **108**. The rectification circuit **108** rectifies the alternating current power **22** to obtain a direct current power **24**. The rectification circuit **108** sends the direct current power **24** to the power factor correction circuit **106**. The power factor correction circuit **106** processes the direct current power **24** to obtain an output voltage **26**. The voltage detection unit **10404** detects the output voltage **26** to obtain a detection signal **282**. The voltage detection unit **10404** sends the detection signal **282** to the control unit **10406**.

When the voltage detection unit **10404** detects that the output voltage **26** of the power factor correction circuit **106** is less than a predetermined voltage, the control unit **10406** enters a hold up time mode to drive the boost unit **10402** to increase the output voltage **26** to obtain a boost voltage **28**. The output side capacitor **10416** receives the boost voltage **28** to supply power to the direct current to direct current converting circuit **102**. Before the hold up time mode is finished, the control unit **10406** sends a first synchronization signal **50** to the management unit **10410** through the isolation unit **10408**. After the control unit **10406** sends the first synchronization signal **50** to the management unit **10410** through the isolation unit **10408**, the auxiliary boost circuit **104** covers (namely, prohibits or stops) a function of the isolation unit **10408** (namely, sending signals from the control unit **10406** to the management unit **10410** is stopped), so that the isolation unit **10408** only has a transmission signal function (namely, only sending signals from the management unit **10410** to the control unit **10406** is available).

After the management unit **10410** receives the first synchronization signal **50**, the management unit **10410** sends back a second synchronization signal **52** to the control unit **10406** through the isolation unit **10408**. After the control unit **10406** receives the second synchronization signal **52** sent from the management unit **10410**, the control unit **10406** turns off the boost unit **10402** before or at the same time the management unit **10410** turns off the direct current to direct current converting circuit **102** (namely, stops the boost unit **10402** and the direct current to direct current converting circuit **102** outputting energy).

When the output voltage **26** is greater than or equal to the predetermined voltage, the control unit **10406** turns on the boost bypass unit **10412** and turns off the boost unit **10402**, so that the output voltage **26** is sent to the direct current to direct current converting circuit **102** through the boost bypass unit **10412**. When the output voltage **26** is less than the predetermined voltage, the control unit **10406** turns off the boost bypass unit **10412** and turns on the boost unit **10402**, so that the boost unit **10402** boosts the output voltage **26** to obtain the boost voltage **28**, and then the boost unit **10402** sends the boost voltage **28** to the direct current to direct current converting circuit **102**.

When the management unit **10410** enters a normal work mode, the management unit **10410** detects the direct current electric power **29** of the direct current to direct current converting circuit **102**. When the direct current electric power **29** of the direct current to direct current converting circuit **102** is less than a predetermined current, the management unit **10410** sends an informing signal to the control unit **10406**. The control unit **10406** drives the power factor correction circuit **106** to increase the output voltage **26**. After the output side capacitor **10416** receives the output voltage **26**, the output side capacitor **10416** supplies power to the direct current to direct current converting circuit **102**.

FIG. **2** shows a waveform diagram of an embodiment of the output voltage and the boost voltage of the power supply of the present invention. Please refer to FIG. **1** at the same time. When the alternating current power supply apparatus **20** supplies the alternating current power **22** normally, the output voltage **26** is a 400 volts direct current power.

When the output voltage **26** is greater than or equal to the predetermined voltage, the control unit **10406** turns on the boost bypass unit **10412** and turns off the boost unit **10402**, so that the output voltage **26** is sent to the direct current to direct current converting circuit **102** through the boost bypass unit **10412**.

When the output voltage **26** is not greater than the predetermined voltage, the control unit **10406** turns off the boost bypass unit **10412** and turns on the boost unit **10402**, so that the boost unit **10402** boosts the output voltage **26** to obtain the boost voltage **28**, and then the boost unit **10402** sends the boost voltage **28** to the direct current to direct current converting circuit **102**. In an embodiment, first, the control unit **10406** turns off the boost bypass unit **10412**, and then the control unit **10406** turns on the boost unit **10402**, so that the power supply **10** is protected more effectively.

Moreover, after the boost unit **10402** boosts the output voltage **26**, the boost unit **10402** boosts the output voltage **26** to obtain the boost voltage **28** (for example 380 volts) and maintains the boost voltage **28** until the output voltage **26** is zero. After the output voltage **26** is zero, the boost voltage **28** decreases to zero with a slope. The boost unit **10402** sends the boost voltage **28** to the direct current to direct current converting circuit **102**.

Moreover, the direct current to direct current converting circuit **102** converts the output voltage **26** (the boost voltage **28**) into the direct current electric power **29**. The direct current to direct current converting circuit **102** sends the direct current electric power **29** to the load apparatus **30**.

When the first synchronization signal **50** is changed from high (namely, a high signal) to low (namely, a low signal), the control unit **10406** sends the first synchronization signal **50** to the management unit **10410** through the isolation unit **10408**. When the second synchronization signal **52** is changed from high (namely, a high signal) to low (namely, a low signal), the management unit **10410** sends the second synchronization signal **52** to the control unit **10406** through the isolation unit **10408**.

The advantage of the present invention is to turns off the auxiliary boost circuit and the direct current to direct current converting circuit at the same time. Or the auxiliary boost circuit is turned off first, and then the direct current to direct current converting circuit is turned off. Therefore, the over voltage phenomenon of the auxiliary boost circuit is eliminated, so that the reliability of the power supply is improved.

Although the present invention has been described with reference to the preferred embodiment thereof, it will be understood that the invention is not limited to the details thereof. Various substitutions and modifications have been suggested in the foregoing description, and others will occur to those of ordinary skill in the art. Therefore, all such

substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.

What is claimed is:

1. A power supply avoiding an auxiliary boost circuit over voltage, the power supply comprising:

a direct current to direct current converting circuit outputting a direct current electric power;

the auxiliary boost circuit electrically connected to the direct current to direct current converting circuit;

a power factor correction circuit electrically connected to the auxiliary boost circuit; and

a rectification circuit electrically connected to the power factor correction circuit,

wherein the auxiliary boost circuit comprises:

a boost unit electrically connected to the direct current to direct current converting circuit and the power factor correction circuit;

a voltage detection unit electrically connected to the power factor correction circuit and the boost unit;

a control unit electrically connected to the power factor correction circuit, the boost unit and the voltage detection unit;

a management unit electrically connected to the direct current to direct current converting circuit; and

an output side capacitor electrically connected to the direct current to direct current converting circuit and the boost unit,

wherein when the voltage detection unit detects that an output voltage of the power factor correction circuit is less than a predetermined voltage, the control unit enters a hold up time mode to drive the boost unit to increase the output voltage to obtain a boost voltage; the output side capacitor receives the boost voltage to supply power to the direct current to direct current converting circuit; before the hold up time mode is finished, the control unit sends a first synchronization signal to the management unit; after the management unit receives the first synchronization signal, the management unit sends a second synchronization signal to the control unit; after the control unit receives the second synchronization signal sent from the management unit, the control unit turns off the boost unit before or at the same time the management unit turns off the direct current to direct current converting circuit.

2. The power supply in claim **1**, wherein the auxiliary boost circuit further comprises:

a boost bypass unit electrically connected to the direct current to direct current converting circuit, the power factor correction circuit, the boost unit, the voltage detection unit and the control unit,

wherein when the output voltage is greater than or equal to the predetermined voltage, the control unit turns on the boost bypass unit and turns off the boost unit, so that the output voltage is sent to the direct current to direct current converting circuit through the boost bypass unit;

wherein when the output voltage is less than the predetermined voltage, the control unit turns off the boost bypass unit and turns on the boost unit, so that the boost unit boosts the output voltage to obtain the boost voltage, and then the boost unit sends the boost voltage to the direct current to direct current converting circuit.

3. The power supply in claim **2**, wherein the auxiliary boost circuit further comprises:

a feedback unit electrically connected to the direct current to direct current converting circuit, the boost unit, the control unit and the boost bypass unit.

4. The power supply in claim **3**, wherein the auxiliary boost circuit further comprises:

an isolation unit,

wherein the direct current to direct current converting circuit comprises a primary side and a secondary side; the control unit is arranged in the primary side; the management unit is arranged in the secondary side; the control unit is electrically connected to the management unit through the isolation unit.

5. The power supply in claim **2**, wherein when the management unit enters a normal work mode, the management unit detects the direct current electric power of the direct current to direct current converting circuit; when the direct current electric power of the direct current to direct current converting circuit is less than a predetermined current, the management unit sends an informing signal to the control unit; the control unit drives the power factor correction circuit to increase the output voltage; after the output side capacitor receives the output voltage, the output side capacitor supplies power to the direct current to direct current converting circuit.

* * * * *